

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-225206
(43)Date of publication of application : 14.08.2002

(51)Int.Cl. B32B 27/32
B32B 27/00
C08K 5/103
C08L 23/10
C08L 45/00
C08L 57/02
C08L 91/00

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(54) STRETCH FILM FOR PACKAGING**(57)Abstract:**

PROBLEM TO BE SOLVED: To provide a stretch film for packaging excellent in characteristics such as transparency, packaging workability, package quality, elastic recovery and bottom seal properties, stability of a film with time and cost effectiveness.

SOLUTION: This stretch film for packaging is composed of at least three layers, in which both of the surface layers are comprised of an ethylenic polymer (A) and at least one of the intermediate layers is comprised of a resin composition including 55-96 wt.% of a polypropylene polymer (B), 3-25 wt.% of petroleum resins (C) and 1-20 wt.% of a liquid additive (D). This provides a stretch film for packaging excellent in transparency, elongation properties, deformation recovery, packaging machinability, workability and the like, and having no problem in waste disposal and food sanitation.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

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CLAIMS

[Claim(s)]

[Claim 1] it constitutes from at least three layers -- having -- both surface layers -- from an ethylene system polymer (A) -- becoming -- at least one layer of an interlayer -- polypropylene system (polymer B) 55-96 % of the weight and (petroleum resin C) 3-25 % of the weight -- and liquefied -- the stretch film for a package characterized by consisting of a resin constituent containing (Additive D) 1-20 % of the weight.

[Claim 2] The stretch film for a package according to claim 1 characterized by being one sort or two sorts or more of mixture chosen from the group which an ethylene system polymer (A) becomes from low density polyethylene, an ethylene-vinylacetate copolymer, an ethylene-acrylic ester copolymer, and an ethylene-methacrylic ester copolymer.

[Claim 3] low density polyethylene -- a line -- low density polyethylene and/or a line -- the stretch film for a package according to claim 2 which is super-low density polyethylene.

[Claim 4] The stretch film for a package given in any 1 term of claims 1-3 characterized by being one sort or two sorts or more of mixture chosen from the group which a polypropylene system polymer (B) becomes from a propylene homopolymer, a propylene-ethylene copolymer, a propylene-alpha olefine copolymer, and amorphous polyolefine.

[Claim 5] The stretch film for a package given in any 1 term of claims 1-4 characterized by being one sort or two sorts or more of mixture chosen from the group which petroleum resin (C) becomes from petroleum resin, terpene resin, coumarone-indene resin, rosin system resin, and those hydrogenation resin.

[Claim 6] The stretch film for a package given in any 1 term of claims 1-5 characterized by being one sort or two sorts or more of mixture chosen from the group which a liquefied additive (D) becomes from a liquid paraffin, a glycerine fatty acid ester, and polyglyceryl fatty acid ester.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the stretch film for a package. Furthermore, it is related with the stretch film for a package which was excellent in transparency and finger push stability at the detail, and was excellent also in cut nature, package heat-sealing nature, and stretchable and which makes polyolefin resin a subject.

[0002]

[Description of the Prior Art] From the former, the thing of a polyvinyl chloride system has mainly been used as the stretch film for food packing, and a stretch film for the so-called prepackaging which garden stuff, prime meat, a fresh fish, a daily dish, etc. are put on a lightweight tray, and is overlapped with a film especially. Although it is manual or is packed with an automatic machine when using the stretch film for prepackaging, it is required that wrapping workability should be good for it. Moreover, there are not a package with the flare which did not leave a wrinkle to goods but suited the configuration of packaging goods-ed, and a tear, and a good-looking package is desired. Furthermore, when packaging goods-ed are displayed at a shop front, the so-called finger push return nature which returns even if it pushes the packed film with a finger and adds deformation is also required.

[0003] What has sufficient film reinforcement, elastic recovery nature, film cut nature, transparency, self-adhesiveness, moderate elongation, slipping nature, and moderate flexibility as a film for food packing in this way is desired. The polyvinyl chloride system film is widely received in the vender and the consumer as what has all the aforementioned engine performance.

[0004] However, the tenderness to an environment comes to be emphasized in recent years, and the hydrogen chloride generation of gas at the time of incineration and the problem of a lot of plasticizer elution have been raised about the polyvinyl chloride system film. For this reason, the ingredient which replaces a polyvinyl chloride system film is examined variously, and the various proposals of the stretch film especially using polyethylene system resin are made.

[0005] For example, the stretch film for a package of two-sort 3 lamination which consists of the surface layer of an ethylene-vinylacetate copolymer and the various alpha olefin system resin middle class like ethylene-vinylacetate copolymer (it may be hereafter called "EVA") / polybutene-1-/EVA, EVA / straight chain-like ethylene-alpha olefine copolymer / EVA, and EVA / polypropylene system polymer / EVA is mentioned.

[0006] Although these things are excellent from viewpoints, such as a surface characteristic, transparency, thermal resistance, a degree of freedom of a materials design, and profitability, they have a difficulty in package workability and package fitness, and are not yet still more enough in respect of profitability.

[0007] The stretch film for food packing containing the polypropylene system polymer and petroleum resin of low crystallinity proposed by JP,9-154479,A, Although properties, such as package workability, a package result, elastic recovery force, and bottom seal nature, are good, in order to obtain the engine performance and to make a large quantity (30 % of the weight) contain petroleum resin, when the reinforcement of a film changed with time, or petroleum resin carries out bleeding to a front face and it makes it a roll, there is nonconformity that films block.

[0008]

[Problem(s) to be Solved by the Invention] Then, the technical problem of this invention is providing the stability pan of a film with time with the stretch film for a package excellent also in profitability in addition to properties, such as transparency, package workability, a package result, elastic recovery force, and bottom seal nature.

[0009]

[Means for Solving the Problem] this invention person etc. consists of at least three layers wholeheartedly as a result of examination, and both surface layers consist of an ethylene system polymer (A). At least one layer of an interlayer Polypropylene system (polymer B) 55-96 % of the weight, (Petroleum resin C) 3-25 % of the weight and liquefied additive (D) It found out that the technical problem of the first half was solvable with the stretch film for a package characterized by consisting of a resin constituent containing 1 - 20 % of the weight. Hereafter, this invention is explained in detail.

[0010]

[Embodiment of the Invention] The stretch film for a package of this invention consists of both surface layers and an interlayer of at least one layer.

[0011] the polymer with which the ethylene system polymer (A) used for the surface layer of this invention uses ethylene as a principal component -- it is -- for example, low density polyethylene and a line -- it is the copolymer which uses super-low density polyethylene, medium density polyethylene, high density polyethylene, and ethylene as a principal component. one sort chosen as a copolymer which uses ethylene as a principal component from unsaturated compounds like unsaturated-carboxylic-acid ester, such as vinyl ester; methyl acrylates, such as ethylene, a propylene and butene-1, a pentene -1, a hexene -1, a heptene -1, alpha olefin; vinyl acetate of the carbon numbers 3-10 of octene-1 grade, and propionic-acid vinyl, an ethyl acrylate, a methyl methacrylate, and ethyl methacrylate, and those ionomer; conjugated dienes and nonconjugated diene, or two sorts or more of copolymers or those constituents with a comonomer are mentioned. The content of the ethylene unit of an ethylene system polymer usually exceeds 50 % of the weight.

[0012] the inside of these ethylene system polymers (A) -- low density polyethylene and a line -- low density polyethylene and a line -- at least one sort of ethylene system polymers chosen from super-low density polyethylene, an ethylene-vinylacetate copolymer, an ethylene-acrylic ester copolymer, and an ethylene-methacrylic ester copolymer are desirable. As acrylic ester, a methyl acrylate and an ethyl acrylate are mentioned, for example. As methacrylic ester, a methyl methacrylate and ethyl methacrylate are mentioned, for example. And in an ethylene system polymer (A), an ethylene-vinylacetate copolymer is more desirable and the ethylene-vinylacetate copolymer whose content of a vinyl acetate unit is 5 - 30 % of the weight is the most desirable.

[0013] In the ethylene system polymer (A) which constitutes said surface layer, various additives can be added further if needed. for example, as an additive for giving fog resistance, a glycerine fatty acid ester, a sorbitan fatty acid ester, polyglyceryl fatty acid ester, an ethyleneoxide addition product, a fatty-acid amine, and a fatty-acid amide are mentioned, and these are independent -- or two or more kinds can use it, mixing.

[0014] As a surfactant, a glycerine fatty acid ester system compound, for example, a glycerine fatty acid ester, or polyglyceryl fatty acid ester is mentioned. Here, the thing of carbon numbers 8-25 is suitable for the fatty-acid part of said compound. Specifically, glycerol mono-olate, glycerine monolaurate, glycerol monostearate, polyglycerin olate, polyglycerin laurate, polyglycerin stearate, polyglycerin sesquiolate, polyglycerin sesquilaurate, polyglycerin mono-lauryl olate, polyglycerin diolate, and a polyglycerin JIRAU rate are mentioned.

[0015] Moreover, an antioxidant, an antifogger, an antistatic agent, lubricant, a nucleating agent, etc. can also be included.

[0016] As a polypropylene system polymer (B) used by this invention, a propylene homopolymer, a propylene-ethylene copolymer, a propylene-alpha olefine copolymer, and amorphous polyolefine are mentioned. As alpha olefin, ethylene, butene-1, a pentene -1, a hexene -1, a heptene -1, and alpha olefin of the carbon numbers 2, 4-10 of octene-1 grade are mentioned, for example.

[0017] Generally the polypropylene system polymer of reinforcement is expensive at high crystallinity, and in a polyolefine system polymer, comparatively, high-melting takes the big force at the time of expansion for high crystallinity, although thermal resistance is also good, and only uneven elongation is shown, but even if these properties become mixture, they remain. Therefore, in this invention, in order to obtain the good film of elongation, it is desirable to use the propylene system copolymer of comparatively low crystallinity for some polypropylene system polymers [at least]. as the copolymer in this case -- a propylene -- ethylene or alpha olefin of carbon numbers 4-12 -- about 3-30 mol % -- what carried out copolymerization is suitable.

[0018] Specifically as said amorphous polyolefine, amorphous polyolefines, such as 50% of the weight or more of polypropylene, polybutene -1, a propylene-ethylene copolymer, a butene-1-ethylene copolymer, a propylene-butene-1 copolymer, propylene-butene-1-ethylene a copolymer of 3 yuan, and butene-1-hexene-1-ethylene a copolymer of 3 yuan, are mentioned for the content of said propylene unit and/or a butene-1 unit. Moreover, you may be two or more sorts of mixture, such as a crystalline propylene polymer and an amorphous propylene polymer.

[0019] Especially the preparation approach in case said polypropylene system polymer (B) is a polymer constituent is not restricted, and heating melting kneading can be carried out using kneading machines, such as a kneader, a Banbury mixer, and a roll, one shaft, or a twin screw extruder, for example, it can be performed. Moreover, the dryblend of the various resin pellets may be carried out. Furthermore, a polymerization blend may be carried out by the multistage polymerization.

[0020] As petroleum resin (C) used for this invention, petroleum resin, terpene resin, coumarone-indene resin, rosin system resin, or those hydrogenation derivatives are mentioned. The copolymerization system petroleum resin which the aliphatic series system petroleum resin which petroleum resin or its hydrogenation object is solid state thermoplastics containing the decomposition oil fraction generated by the pyrolysis of petroleum, for example, used C5 fraction as the raw material, the aromatic series system petroleum resin which used C9 fraction as the raw material, the alicycle group petroleum resin which used the cyclopentadiene as the raw material, and those two kinds or more copolymerized, and the hydrogenation system petroleum resin which hydrogenated them further are mentioned. The aromatic series denaturation terpene resin and hydrogenation terpene resin which gave the polarity with the terpene resin in which terpene resin is resin which used turpentine oil as the raw material, for example, the alpha pinene and beta-pinene carried out the polymerization, the terpene phenol resin which carried out the polymerization of phenol resin and the terpene resin, styrene, etc. are mentioned. Coumarone-indene resin is resin which consists of a polymerization object which uses coumarone and an indene as a principal component. The rosin phenol resin to which rosin system resin is resin which uses as a principal component the abietic acid obtained from the resin of pines etc. or its derivative, for example, gum rosin, wood rosin, hydrogenation rosin, and a phenol and rosin were made to react is mentioned.

[0021] As for the liquefied additive (D) used for this invention, surfactants, such as a liquid paraffin, a glycerine fatty acid ester, and polyglyceryl fatty acid ester, etc. are mentioned. a liquid paraffin -- general -- from the high saturated hydrocarbon of whenever [transparent and colorless and tasteless purification / odorless] -- becoming -- the consistency in 15 degrees C -- 0.85 - 0.91 g/cm³ -- desirable -- 0.85 - 0.88 g/cm³ -- it is -- the kinematic viscosity in 40 degrees C -- 5-100mm²/S -- the thing of 10-80mm²/S is preferably suitable. Especially since slipping with a screw does not arise at the time of a granulation or film production, and too much adhesion by the liquid paraffin does not arise, when the close consistency and the kinematic viscosity of a liquid paraffin are in said range, and handling is easy, it is desirable.

[0022] moreover, what gives fog resistance as a surfactant is used, it is specifically a glycerine fatty acid ester, a sorbitan fatty acid ester, polyglyceryl fatty acid ester, an ethyleneoxide addition product, a fatty-acid amine, a fatty-acid amide, etc., and these are independent -- or two or more kinds can use it, mixing. As a surfactant used suitable for especially this invention, a glycerine fatty acid ester system compound, for example, a glycerine fatty acid ester, or

polyglyceryl fatty acid ester is mentioned. Here, the thing of carbon numbers 8-25 is suitable for the fatty-acid part of said compound. Specifically, glycerol mono-olate, glycerine monolaurate, glycerol monostearate, polyglycerin olate, polyglycerin laurate, polyglycerin stearate, polyglycerin sesquiolate, polyglycerin sesquilaurate, polyglycerin mono-lauryl olate, polyglycerin diolate, and a polyglycerin JIRAU rate are mentioned.

[0023] By blending such a liquefied additive, the polyolefine film obtained becomes that the base seal nature at the time of stretch packaging and whose self-adhesiveness of films improved, and even if it carries out stretch packaging for a high scale factor, a poor appearance stops being able to generate it easily. The liquefied additive blended with an interlayer compatibilizes with an interlayer's polypropylene system polymer as a reason which such effectiveness discovers, consequently the plastic effectiveness is demonstrated, and it thinks for the interface reinforcement between the polypropylene system polymer used for an interlayer and the ethylene system polymer used for both surface layers also increasing further.

[0024] the mixed rate of the (B), (C), and the (D) component of the resin constituent which forms the interlayer of this invention is [said polypropylene system polymer (B) 55 - 2 - 25 % of the weight of petroleum resin (C) components] liquefied 97% of the weight -- it is (Additive D) 1-20 % of the weight. Film production nature becomes that a polypropylene system polymer (B) is less than 55 % of the weight unstable, and thermal resistance falls and is not desirable, either. Moreover, if 97 % of the weight is exceeded, flexibility will fall. Films block and are not desirable, when the cut nature of a film, on the other hand, falls that the rate of petroleum resin (C) is less than 2 % of the weight, and 25 % of the weight was exceeded, and the shock resistance of a film falls, or petroleum resin carries out bleeding to a front face and it considers as a roll. Moreover, if flexibility falls that a liquefied additive (D) is less than 1 % of the weight and 20 % of the weight is exceeded, film production nature will get worse. especially -- polypropylene system (polymer B) 65-85 % of the weight and petroleum resin (C) -- liquefied ten to 20% of the weight -- the resin constituent containing (Additive D) 2-15 % of the weight is desirable from a viewpoint of the balance of flexibility, thermal resistance, cut nature, and shock-resistant reinforcement.

[0025] Especially the preparation approach of the resin constituent used for one layer of an interlayer by this invention is not restricted, and heating melting kneading can be carried out using kneading machines, such as a kneader, a Banbury mixer, and a roll, one shaft, or a twin screw extruder, for example, it can be performed. Moreover, the dryblend of the various resin pellets may be carried out.

[0026] Moreover, various additives, a bulking agent, for example, an antioxidant, an antistatic agent, a nucleating additive, a flame retarder, etc. can be further included in the resin constituent which constitutes the aforementioned interlayer if needed. Furthermore, other resin can also be blended and used in the range which does not become the hindrance of this invention. For example, recycle resin can also be blended.

[0027] The stretch film for a package of this invention may carry out laminating insertion of polyamide resin, an ethylene-vinylalcohol copolymer, the polyester resin, etc., in order to carry out laminating insertion of the recycle resin layer and to give the middle class, other thermoplastics layers, for example, gas barrier property. Furthermore, in order to raise the bond strength between layers, laminating insertion of adhesives or the adhesive resin layer may be carried out.

[0028] Especially the thickness of each class which constitutes the stretch film for a package of this invention is not limited, and can be chosen as arbitration. Usually, each class is formed in the range of about 2-100 micrometers. Moreover, the thickness ratio of both the surface layers to the film total thickness is not limited especially, either, and can be chosen as arbitration. Usually, the sum total thickness of both surface layers is constituted so that it may become 20 - 90% of laminated film thickness.

[0029] Especially the process of the stretch film for a package of this invention is not limited, and the co-extrusion laminated layers method according [for example,] to a tubular film process or the cast method, an extrusion lamination process, a sand lamination process, a dry lamination process, etc. can be used for it.

[0030] It is desirable to extend after film production to the stretch film for a package of this

invention, at at least 1 shaft orientations, when shrinkage characteristics are required. The drawing is possible also with one shaft or two shafts. When it is uniaxial stretching, the roll extending method usually used is desirable. Moreover, in the case of biaxial stretching, after extending for example, on one shaft, the serial drawing method which performs biaxial stretching may be used, and a simultaneous biaxial-stretching method like a tubular drawing is sufficient as it.

[0031] As explained in full detail above, according to this invention, transparency is good and can offer the stretch film for a package excellent in flexibility, deformation recoverability, cut nature, thermal resistance, and shock resistance. Moreover, the stretch film for a package of this invention is an elasticity film, and can be applied to various applications instead of the elasticity vinyl chloride film which poses a social problem by environmental pollution.

[0032] Next, although an example is given and this invention is explained in more detail, this invention is not limited to these examples.

[0033]

[Example] The following approach measured and estimated the property and engine performance of a film.

[0034] (Transparency (1)) Viewing estimated the transparency (bleeding milkiness etc.) of a film. O x as which O milkiness as which it is transparent and milkiness is not regarded is regarded a little and as which milkiness is regarded although it is transparent -- not transparent [0035] (Bottom seal nature) Heating plate temperature was made into 100 degrees C, and the seal condition after a package was evaluated.

O O which does not separate in the usual handling -- a hole occurs with x heat which peeling produces slightly and which peeling produces a little, and it is easy to separate [0036] (Stability) The situation after the push after pushing a pack center section with a finger was evaluated.

O O restored thoroughly -- whether incrustation remains slightly and x in which it becomes and incrustation remains -- incrustation remains thoroughly [0037] (Flare) The resilience when pressing down the top face of a pack article by hand and the sag when putting were evaluated.

O O with it -- it becomes [whether a flare is a little weak and], and x flare with a weak flare is weak, is uncertain, and also produces sag [good a flare and sufficient / the resilience] [0038] (Manual package assessment) Using the stretch film with a width of 350mm, it packed with the hand packaging machine (401made from ARC-U), and evaluated.

[0039] (Result) The tray corner section which especially Siwa tends to generate was evaluated.

O O without Siwa -- x with a little Siwa which has Siwa slightly -- big Siwa occurs [0040] (Stretchable (1)) The elongation and reinforcement of a film when extending a film in a longitudinal direction by hand were evaluated.

O moderate elongation -- it is -- strong O some elongation -- being hard -- although -- strong -- although extended -- weak x elongation -- hard -- weak [0041] (Automatic packer assessment) a stretch film with a width of 350mm -- using -- ISHIDA-Zero made from automatic packer Ishida **** Co. one and Teraoka elaborate company make -- the form polystyrene tray (die length of 200mm, width of face of 130mm, height of 30mm) was packed by AW-3600, and it evaluated.

[0042] (Cut conveyance) O which evaluated the chuck condition at the time of curl of the cutting plane at the time of a cut, or conveyance -- O which is completely satisfactory -- so so -- it is a little problematic and x cut conveyance cannot be carried out [0043] (Stretchable (2)) AW3600 made from TERAOKA packaging machine estimated stretchable [when carrying out prestretching].

O O some elongation on which has moderate elongation and a film is not torn to pieces -- being hard -- although -- although extended, there is a thing in which a film is not torn to pieces and which is torn to pieces -- a **** package cannot be x extended and carried out [0044] (Result) Package conditions were changed into 25 levels and the good rate of the number of levels was evaluated.

O 16/25 / 25O11 / 25 - 15/25 4/25-10/25x 0/25- 3/25 [25-25] [0045] (Transparency (2)) AW3600 made from TERAOKA packaging machine estimated the condition of milkiness of the front face when carrying out prestretching.

O it has not milked, and although O milkiness of is not done, it has milked a little [transparent] which has become muddy -- x milkiness of is done [0046] (Example 1) As a surface layer Ethylene-vinylacetate copolymer (MFR(190 degrees C) =2g /, and ten parts) content =15% of the weight of a vinyl acetate unit, and the Sumitomo Chemical Co., Ltd. make -- the layer of the constituent which kneaded Eve Tait H2081(A)98 % of the weight and 2 % of the weight (L[by Riken Vitamin Co., Ltd.]-71-D) of antifoggers as 4 micrometers of each, and an interlayer 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make CAP355 (B) 75 % of the weight, (petroleum resin (Yasuhara Chemical chestnut ARON P125) C) 20 % of the weight, Liquid paraffin (Esso Sekiyu coulisse toll J-352) (D) Co-extrusion inflation molding of the 4 micrometers of the layers of 5% of the weight of a mixed resin constituent was carried out, and the film of 12 micrometers of bed depths (4 micrometers / 4 micrometers / 4 micrometers) was obtained.

[0047] (Example 2) The film was obtained like the example 1 except having used 75 % of the weight (MFR(230 degrees C) =0.45g /, 10-minute Montel KS353 P) of propylene-ethylene random copolymers which are a low crystallinity propylene-ethylene-propylene copolymerization elastomer as a (B) component of the resin constituent which constitutes the middle class.

[0048] (Example 3) As the (B) component of the resin constituent which constitutes an interlayer The propylene-ethylene random copolymer which is a crystalline propylene-alpha olefin copolymer (MFR (230 degrees C) =2.5g /, and no BUREN FSby 10-minute Sumitomo Chemical Co., Ltd.2011D), 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make The film was obtained like the example 1 except having used 75 % of the weight of same weight mixing resin constituents with CAP355.

[0049] (Example 4) As a (D) component of the resin constituent which constitutes the middle class, the film was obtained like the example 1 except having used the surface active agent (L [by Riken Vitamin Co., Ltd.]-71-D).

[0050] (Example 1 of a comparison) As the (B) component of the resin constituent which constitutes an interlayer crystallinity -- polypropylene -- amorphia -- a propylene - butene-1 - a copolymer -- 50 -- /-- 50 -- % of the weight -- mixing -- a constituent (MFR(230 degrees C) =14g /, 10-minute, and CAP355 by Ube Rexene) -- 70 -- % of the weight -- (-- C --) -- a component -- ***** -- petroleum resin -- a kind (Yasuhara Chemical chestnut ARON P125) -- 30 -- % of the weight -- using -- (-- D --) -- a component -- zero -- ** -- having carried out -- except -- an example 1 -- the same -- a film -- having obtained .

[0051] (Example 2 of a comparison) As the (B) component of the resin constituent which constitutes an interlayer The film was obtained like the example 1 except having set the (D) component to 0, using 30 % of the weight (Yasuhara Chemical chestnut ARON P125) of petroleum resin as 70 % of the weight (MFR(230 degrees C) =0.45g /, 10-minute, and product KS353 made from Montel-JPO P) of low crystallinity propylene-ethylene-propylene copolymerization elastomers, and a (C) component.

[0052] (Example 3 of a comparison) As the resin constituent which constitutes an interlayer The propylene-ethylene random copolymer which is a crystalline propylene-alpha olefin copolymer (MFR(230 degrees C) =2.5g /, and ten parts) The content of a propylene unit = 99.6-% of the weight and no BUREN FSby Sumitomo Chemical Co., Ltd.2011D, 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make The film was obtained like the example 1 using same weight (mixture B) 70 % of the weight with CAP355, and (petroleum resin (Yasuhara Chemical chestnut ARON P125) C) 30 % of the weight except having set the (D) component to 0.

[0053]

[A table 1]

	共通				手包装		自動包装					
	透明性 (1)	底シール性	復元性	張り	仕上がり	ストレッチ性 (1)	イシダ Zero one		テラオカ AW3600			
							カット搬送	仕上がり	カット搬送	ストレッチ性 (2)	仕上がり	透明性 (2)
実施例 1	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
実施例 2	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
実施例 3	◎	○	○	○	◎	◎	◎	◎	◎	○	○	○
実施例 4	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
比較例 1	▲	○	▲	○	○	○	○	○	○	○	○	▲
比較例 2	▲	○	▲	○	○	○	○	○	○	○	○	▲
比較例 3	▲	○	×	○	○	○	◎	○	◎	▲	▲	▲

[0054]

[Effect of the Invention] The stretch film for a package which is suitable to use it excluding chlorine with a manual package, a pressure-from-below type automatic packer, and a prestretching automatic packer substantially, and is excellent in transparency, an elongation property, deformation recoverability, packaging-machinery fitness, workability, etc. with this invention, and does not have a problem on abolition processing and food sanitation hygiene is obtained.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the stretch film for a package. Furthermore, it is related with the stretch film for a package which was excellent in transparency and finger push stability at the detail, and was excellent also in cut nature, package heat-sealing nature, and stretchable and which makes polyolefin resin a subject.

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PRIOR ART

[Description of the Prior Art] From the former, the thing of a polyvinyl chloride system has mainly been used as the stretch film for food packing, and a stretch film for the so-called prepackaging which garden stuff, prime meat, a fresh fish, a daily dish, etc. are put on a lightweight tray, and is overlapped with a film especially. Although it is manual or is packed with an automatic machine when using the stretch film for prepackaging, it is required that wrapping workability should be good for it. Moreover, there are not a package with the flare which did not leave a wrinkle to goods but suited the configuration of packaging goods-ed, and a tear, and a good-looking package is desired. Furthermore, when packaging goods-ed are displayed at a shop front, the so-called finger push return nature which returns even if it pushes the packed film with a finger and adds deformation is also required.

[0003] What has sufficient film reinforcement, elastic recovery nature, film cut nature, transparency, self-adhesiveness, moderate elongation, slipping nature, and moderate flexibility as a film for food packing in this way is desired. The polyvinyl chloride system film is widely received in the vender and the consumer as what has all the aforementioned engine performance.

[0004] However, the tenderness to an environment comes to be emphasized in recent years, and the hydrogen chloride generation of gas at the time of incineration and the problem of a lot of plasticizer elution have been raised about the polyvinyl chloride system film. For this reason, the ingredient which replaces a polyvinyl chloride system film is examined variously, and the various proposals of the stretch film especially using polyethylene system resin are made.

[0005] For example, the stretch film for a package of two-sort 3 lamination which consists of the surface layer of an ethylene-vinylacetate copolymer and the various alpha olefin system resin middle class like ethylene-vinylacetate copolymer (it may be hereafter called "EVA") / polybutene-1-/EVA, EVA / straight chain-like ethylene-alpha olefine copolymer / EVA, and EVA / polypropylene system polymer / EVA is mentioned.

[0006] Although these things are excellent from viewpoints, such as a surface characteristic, transparency, thermal resistance, a degree of freedom of a materials design, and profitability, they have a difficulty in package workability and package fitness, and are not yet still more enough in respect of profitability.

[0007] The stretch film for food packing containing the polypropylene system polymer and petroleum resin of low crystallinity proposed by JP,9-154479,A, Although properties, such as package workability, a package result, elastic recovery force, and bottom seal nature, are good, in order to obtain the engine performance and to make a large quantity (30 % of the weight) contain petroleum resin, when the reinforcement of a film changed with time, or petroleum resin carries out bleeding to a front face and it makes it a roll, there is nonconformity that films block.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] The stretch film for a package which is suitable to use it excluding chlorine with a manual package, a pressure-from-below type automatic packer, and a prestretching automatic packer substantially, and is excellent in transparency, an elongation property, deformation recoverability, packaging-machinery fitness, workability, etc. with this invention, and does not have a problem on abolition processing and food sanitation hygiene is obtained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Then, the technical problem of this invention is providing the stability pan of a film with time with the stretch film for a package excellent also in profitability in addition to properties, such as transparency, package workability, a package result, elastic recovery force, and bottom seal nature.

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MEANS

[Means for Solving the Problem] this invention person etc. consists of at least three layers wholeheartedly as a result of examination, and both surface layers consist of an ethylene system polymer (A). At least one layer of an interlayer Polypropylene system (polymer B) 55-96 % of the weight, (Petroleum resin C) 3-25 % of the weight and liquefied additive (D) It found out that the technical problem of the first half was solvable with the stretch film for a package characterized by consisting of a resin constituent containing 1 - 20 % of the weight. Hereafter, this invention is explained in detail.

[0010]

[Embodiment of the Invention] The stretch film for a package of this invention consists of both surface layers and an interlayer of at least one layer.

[0011] the polymer with which the ethylene system polymer (A) used for the surface layer of this invention uses ethylene as a principal component -- it is -- for example, low density polyethylene and a line -- low density polyethylene and a line -- it is the copolymer which uses super-low density polyethylene, medium density polyethylene, high density polyethylene, and ethylene as a principal component. one sort chosen as a copolymer which uses ethylene as a principal component from unsaturated compounds like unsaturated-carboxylic-acid ester, such as vinyl ester; methyl acrylates, such as ethylene, a propylene and butene-1, a pentene -1, a hexene -1, a heptene -1, alpha olefin; vinyl acetate of the carbon numbers 3-10 of octene-1 grade, and propionic-acid vinyl, an ethyl acrylate, a methyl methacrylate, and ethyl methacrylate, and those ionomer; conjugated dienes and nonconjugated diene, or two sorts or more of copolymers or those constituents with a comonomer are mentioned. The content of the ethylene unit of an ethylene system polymer usually exceeds 50 % of the weight.

[0012] the inside of these ethylene system polymers (A) -- low density polyethylene and a line -- low density polyethylene and a line -- at least one sort of ethylene system polymers chosen from super-low density polyethylene, an ethylene-vinylacetate copolymer, an ethylene-acrylic ester copolymer, and an ethylene-methacrylic ester copolymer are desirable. As acrylic ester, a methyl acrylate and an ethyl acrylate are mentioned, for example. As methacrylic ester, a methyl methacrylate and ethyl methacrylate are mentioned, for example. And in an ethylene system polymer (A), an ethylene-vinylacetate copolymer is more desirable and the ethylene-vinylacetate copolymer whose content of a vinyl acetate unit is 5 - 30 % of the weight is the most desirable.

[0013] In the ethylene system polymer (A) which constitutes said surface layer, various additives can be added further if needed. for example, as an additive for giving fog resistance, a glycerine fatty acid ester, a sorbitan fatty acid ester, polyglyceryl fatty acid ester, an ethyleneoxide addition product, a fatty-acid amine, and a fatty-acid amide are mentioned, and these are independent -- or two or more kinds can use it, mixing.

[0014] As a surfactant, a glycerine fatty acid ester system compound, for example, a glycerine fatty acid ester, or polyglyceryl fatty acid ester is mentioned. Here, the thing of carbon numbers 8-25 is suitable for the fatty-acid part of said compound. Specifically, glycerol mono-olate, glycerine monolaurate, glycerol monostearate, polyglycerin olate, polyglycerin laurate, polyglycerin stearate, polyglycerin sesquiolate, polyglycerin sesquilaurate, polyglycerin mono-lauryl olate, polyglycerin diolate, and a polyglycerin JIRAU rate are mentioned.

[0015] Moreover, an antioxidant, an antifogger, an antistatic agent, lubricant, a nucleating agent, etc. can also be included.

[0016] As a polypropylene system polymer (B) used by this invention, a propylene homopolymer, a propylene-ethylene copolymer, a propylene-alpha olefine copolymer, and amorphous polyolefine are mentioned. As alpha olefin, ethylene, butene-1, a pentene -1, a hexene -1, a heptene -1, and alpha olefin of the carbon numbers 2, 4-10 of octene-1 grade are mentioned, for example.

[0017] Generally the polypropylene system polymer of reinforcement is expensive at high crystallinity, and in a polyolefine system polymer, comparatively, high-melting takes the big force at the time of expansion for high crystallinity, although thermal resistance is also good, and only uneven elongation is shown, but even if these properties become mixture, they remain. Therefore, in this invention, in order to obtain the good film of elongation, it is desirable to use the propylene system copolymer of comparatively low crystallinity for some polypropylene system polymers [at least]. as the copolymer in this case -- a propylene -- ethylene or alpha olefin of carbon numbers 4-12 -- about 3-30 mol % -- what carried out copolymerization is suitable.

[0018] Specifically as said amorphous polyolefine, amorphous polyolefines, such as 50% of the weight or more of polypropylene, polybutene -1, a propylene-ethylene copolymer, a butene-1-ethylene copolymer, a propylene-butene-1 copolymer, propylene-butene-1-ethylene a copolymer of 3 yuan, propylene-hexene-1-ethylene a copolymer of 3 yuan, and butene-1-hexene-1-ethylene a copolymer of 3 yuan, are mentioned for the content of said propylene unit and/or a butene-1 unit. Moreover, you may be two or more sorts of mixture, such as a crystalline propylene polymer and an amorphous propylene polymer.

[0019] Especially the preparation approach in case said polypropylene system polymer (B) is a polymer constituent is not restricted, and heating melting kneading can be carried out using kneading machines, such as a kneader, a Banbury mixer, and a roll, one shaft, or a twin screw extruder, for example, it can be performed. Moreover, the dryblend of the various resin pellets may be carried out. Furthermore, a polymerization blend may be carried out by the multistage polymerization.

[0020] As petroleum resin (C) used for this invention, petroleum resin, terpene resin, coumarone-indene resin, rosin system resin, or those hydrogenation derivatives are mentioned. The copolymerization system petroleum resin which the aliphatic series system petroleum resin which petroleum resin or its hydrogenation object is solid state thermoplastics containing the decomposition oil fraction generated by the pyrolysis of petroleum, for example, used C5 fraction as the raw material, the aromatic series system petroleum resin which used C9 fraction as the raw material, the alicycle group petroleum resin which used the cyclopentadiene as the raw material, and those two kinds or more copolymerized, and the hydrogenation system petroleum resin which hydrogenated them further are mentioned. The aromatic series denaturation terpene resin and hydrogenation terpene resin which gave the polarity with the terpene resin in which terpene resin is resin which used turpentine oil as the raw material, for example, the alpha pinene and beta-pinene carried out the polymerization, the terpene phenol resin which carried out the polymerization of phenol resin and the terpene resin, styrene, etc. are mentioned. Coumarone-indene resin is resin which consists of a polymerization object which uses coumarone and an indene as a principal component. The rosin phenol resin to which rosin system resin is resin which uses as a principal component the abietic acid obtained from the resin of pines etc. or its derivative, for example, gum rosin, wood rosin, hydrogenation rosin, and a phenol and rosin were made to react is mentioned.

[0021] As for the liquefied additive (D) used for this invention, surfactants, such as a liquid paraffin, a glycerine fatty acid ester, and polyglyceryl fatty acid ester, etc. are mentioned. a liquid paraffin -- general -- from the high saturated hydrocarbon of whenever [transparent and colorless and tasteless purification / odorless] -- becoming -- the consistency in 15 degrees C -- 0.85 - 0.91 g/cm³ -- desirable -- 0.85 - 0.88 g/cm³ -- it is -- the kinematic viscosity in 40 degrees C -- 5-100mm²/S -- the thing of 10-80mm²/S is preferably suitable. Especially since slipping with a screw does not arise at the time of a granulation or film production, and too much

adhesion by the liquid paraffin does not arise, when the close consistency and the kinematic viscosity of a liquid paraffin are in said range, and handling is easy, it is desirable.

[0022] moreover, what gives fog resistance as a surfactant is used, it is specifically a glycerine fatty acid ester, a sorbitan fatty acid ester, polyglyceryl fatty acid ester, an ethyleneoxide addition product, a fatty-acid amine, a fatty-acid amide, etc., and these are independent -- or two or more kinds can use it, mixing. As a surfactant used suitable for especially this invention, a glycerine fatty acid ester system compound, for example, a glycerine fatty acid ester, or polyglyceryl fatty acid ester is mentioned. Here, the thing of carbon numbers 8-25 is suitable for the fatty-acid part of said compound. Specifically, glycerol mono-olate, glycerine monolaurate, glycerol monostearate, polyglycerin olate, polyglycerin laurate, polyglycerin stearate, polyglycerin sesquiolate, polyglycerin sesquilaurate, polyglycerin mono-lauryl olate, polyglycerin diolate, and a polyglycerin JIRAU rate are mentioned.

[0023] By blending such a liquefied additive, the polyolefine film obtained becomes that the base seal nature at the time of stretch packaging and whose self-adhesiveness of films improved, and even if it carries out stretch packaging for a high scale factor, a poor appearance stops being able to generate it easily. The liquefied additive blended with an interlayer compatibilizes with an interlayer's polypropylene system polymer as a reason which such effectiveness discovers, consequently the plastic effectiveness is demonstrated, and it thinks for the interface reinforcement between the polypropylene system polymer used for an interlayer and the ethylene system polymer used for both surface layers also increasing further.

[0024] the mixed rate of the (B), (C), and the (D) component of the resin constituent which forms the interlayer of this invention is [said polypropylene system polymer (B) 55 - 2 - 25 % of the weight of petroleum resin (C) components] liquefied 97% of the weight -- it is (Additive D) 1-20 % of the weight. Film production nature becomes that a polypropylene system polymer (B) is less than 55 % of the weight unstable, and thermal resistance falls and is not desirable, either. Moreover, if 97 % of the weight is exceeded, flexibility will fall. Films block and are not desirable, when the cut nature of a film, on the other hand, falls that the rate of petroleum resin (C) is less than 2 % of the weight, and 25 % of the weight was exceeded, and the shock resistance of a film falls, or petroleum resin carries out bleeding to a front face and it considers as a roll. Moreover, if flexibility falls that a liquefied additive (D) is less than 1 % of the weight and 20 % of the weight is exceeded, film production nature will get worse. especially -- polypropylene system (polymer B) 65-85 % of the weight and petroleum resin (C) -- liquefied ten to 20% of the weight -- the resin constituent containing (Additive D) 2-15 % of the weight is desirable from a viewpoint of the balance of flexibility, thermal resistance, cut nature, and shock-resistant reinforcement.

[0025] Especially the preparation approach of the resin constituent used for one layer of an interlayer by this invention is not restricted, and heating melting kneading can be carried out using kneading machines, such as a kneader, a Banbury mixer, and a roll, one shaft, or a twin screw extruder, for example, it can be performed. Moreover, the dryblend of the various resin pellets may be carried out.

[0026] Moreover, various additives, a bulking agent, for example, an antioxidant, an antistatic agent, a nucleating additive, a flame retarder, etc. can be further included in the resin constituent which constitutes the aforementioned interlayer if needed. Furthermore, other resin can also be blended and used in the range which does not become the hindrance of this invention. For example, recycle resin can also be blended.

[0027] The stretch film for a package of this invention may carry out laminating insertion of polyamide resin, an ethylene-vinylalcohol copolymer, the polyester resin, etc., in order to carry out laminating insertion of the recycle resin layer and to give the middle class, other thermoplastics layers, for example, gas barrier property. Furthermore, in order to raise the bond strength between layers, laminating insertion of adhesives or the adhesive resin layer may be carried out.

[0028] Especially the thickness of each class which constitutes the stretch film for a package of this invention is not limited, and can be chosen as arbitration. Usually, each class is formed in the range of about 2-100 micrometers. Moreover, the thickness ratio of both the surface layers to the film total thickness is not limited especially, either, and can be chosen as arbitration.

Usually, the sum total thickness of both surface layers is constituted so that it may become 20 - 90% of laminated film thickness.

[0029] Especially the process of the stretch film for a package of this invention is not limited, and the co-extrusion laminated layers method according [for example,] to a tubular film process or the cast method, an extrusion lamination process, a sand lamination process, a dry lamination process, etc. can be used for it.

[0030] It is desirable to extend after film production to the stretch film for a package of this invention, at at least 1 shaft orientations, when shrinkage characteristics are required. The drawing is possible also with one shaft or two shafts. When it is uniaxial stretching, the roll extending method usually used is desirable. Moreover, in the case of biaxial stretching, after extending for example, on one shaft, the serial drawing method which performs biaxial stretching may be used, and a simultaneous biaxial-stretching method like a tubular drawing is sufficient as it.

[0031] As explained in full detail above, according to this invention, transparency is good and can offer the stretch film for a package excellent in flexibility, deformation recoverability, cut nature, thermal resistance, and shock resistance. Moreover, the stretch film for a package of this invention is an elasticity film, and can be applied to various applications instead of the elasticity vinyl chloride film which poses a social problem by environmental pollution.

[0032] Next, although an example is given and this invention is explained in more detail, this invention is not limited to these examples.

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EXAMPLE

[Example] The following approach measured and estimated the property and engine performance of a film.

[0034] (Transparency (1)) Viewing estimated the transparency (bleeding milkiness etc.) of a film. O x as which O milkiness as which it is transparent and milkiness is not regarded is regarded a little and as which milkiness is regarded although it is transparent -- not transparent [0035] (Bottom seal nature) Heating plate temperature was made into 100 degrees C, and the seal condition after a package was evaluated.

O O which does not separate in the usual handling -- a hole occurs with x heat which peeling produces slightly and which peeling produces a little, and it is easy to separate [0036] (Stability) The situation after the push after pushing a pack center section with a finger was evaluated.

O O restored thoroughly -- whether incrustation remains slightly and x in which it becomes and incrustation remains -- incrustation remains thoroughly [0037] (Flare) The resilience when pressing down the top face of a pack article by hand and the sag when putting were evaluated.

O O with it -- it becomes [whether a flare is a little weak and], and x flare with a weak flare is weak, is uncertain, and also produces sag [good a flare and sufficient / the resilience] [0038] (Manual package assessment) Using the stretch film with a width of 350mm, it packed with the hand packaging machine (401 made from ARC-U), and evaluated.

[0039] (Result) The tray corner section which especially Siwa tends to generate was evaluated.

O O without Siwa -- x with a little Siwa which has Siwa slightly -- big Siwa occurs [0040] (Stretchable (1)) The elongation and reinforcement of a film when extending a film in a longitudinal direction by hand were evaluated.

O moderate elongation -- it is -- strong O some elongation -- being hard -- although -- strong -- although extended -- weak x elongation -- hard -- weak [0041] (Automatic packer assessment) a stretch film with a width of 350mm -- using -- ISHIDA-Zero made from automatic packer Ishida **** Co. one and Teraoka elaborate company make -- the form polystyrene tray (die length of 200mm, width of face of 130mm, height of 30mm) was packed by AW-3600, and it evaluated.

[0042] (Cut conveyance) O which evaluated the chuck condition at the time of curl of the cutting plane at the time of a cut, or conveyance -- O which is completely satisfactory -- so so -- it is a little problematic and x cut conveyance cannot be carried out [0043] (Stretchable (2)) AW3600 made from TERAOKA packaging machine estimated stretchable [when carrying out prestretching].

O O some elongation on which has moderate elongation and a film is not torn to pieces -- being hard -- although -- although extended, there is a thing in which a film is not torn to pieces and which is torn to pieces -- a **** package cannot be x extended and carried out [0044] (Result) Package conditions were changed into 25 levels and the good rate of the number of levels was evaluated.

O 16/25 / 25 O 11 / 25 - 15/25 4/25-10/25x 0/25- 3/25 [25-25] [0045] (Transparency (2)) AW3600 made from TERAOKA packaging machine estimated the condition of milkiness of the front face when carrying out prestretching.

O it has not milked, and although O milkiness of is not done, it has milked a little [transparent]

which has become muddy -- x milkiness of is done [0046] (Example 1) As a surface layer Ethylene-vinylacetate copolymer (MFR(190 degrees C) =2g /, and ten parts) content =15% of the weight of a vinyl acetate unit, and the Sumitomo Chemical Co., Ltd. make -- the layer of the constituent which kneaded Eve Tait H2081(A)98 % of the weight and 2 % of the weight (L[by Riken Vitamin Co., Ltd.]-71-D) of antifoggers as 4 micrometers of each, and an interlayer 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make CAP355 (B) 75 % of the weight, (petroleum resin (Yasuhara Chemical chestnut ARON P125) C) 20 % of the weight, Liquid paraffin (Esso Sekiyu coulisse toll J-352) (D) Co-extrusion inflation molding of the 4 micrometers of the layers of 5% of the weight of a mixed resin constituent was carried out, and the film of 12 micrometers of bed depths (4 micrometers / 4 micrometers / 4 micrometers) was obtained.

[0047] (Example 2) The film was obtained like the example 1 except having used 75 % of the weight (MFR(230 degrees C) =0.45g /, 10-minute Montel KS353 P) of propylene-ethylene random copolymers which are a low crystallinity propylene-ethylene-propylene copolymerization elastomer as a (B) component of the resin constituent which constitutes the middle class.

[0048] (Example 3) As the (B) component of the resin constituent which constitutes an interlayer The propylene-ethylene random copolymer which is a crystalline propylene-alpha olefin copolymer (MFR (230 degrees C) =2.5g /, and no BUREN FSby 10-minute Sumitomo Chemical Co., Ltd.2011D), 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make The film was obtained like the example 1 except having used 75 % of the weight of same weight mixing resin constituents with CAP355.

[0049] (Example 4) As a (D) component of the resin constituent which constitutes the middle class, the film was obtained like the example 1 except having used the surface active agent (L [by Riken Vitamin Co., Ltd.]-71-D).

[0050] (Example 1 of a comparison) As the (B) component of the resin constituent which constitutes an interlayer crystallinity -- polypropylene -- amorphia -- a propylene - butene-1 - - a copolymer -- 50 -- /-- 50 -- % of the weight -- mixing -- a constituent (MFR(230 degrees C) =14g /, 10-minute, and CAP355 by Ube Rexene) -- 70 -- % of the weight -- (-- C --) -- a component -- ***** -- petroleum resin -- a kind (Yasuhara Chemical chestnut ARON P125) - - 30 -- % of the weight -- using -- (-- D --) -- a component -- zero -- ** -- having carried out -- except -- an example 1 -- the same -- a film -- having obtained .

[0051] (Example 2 of a comparison) As the (B) component of the resin constituent which constitutes an interlayer The film was obtained like the example 1 except having set the (D) component to 0, using 30 % of the weight (Yasuhara Chemical chestnut ARON P125) of petroleum resin as 70 % of the weight (MFR(230 degrees C) =0.45g /, 10-minute, and product KS353 made from Montel-JPO P) of low crystallinity propylene-ethylene-propylene copolymerization elastomers, and a (C) component.

[0052] (Example 3 of a comparison) As the resin constituent which constitutes an interlayer The propylene-ethylene random copolymer which is a crystalline propylene-alpha olefin copolymer (MFR(230 degrees C) =2.5g /, and ten parts) The content of a propylene unit = 99.6-% of the weight and no BUREN FSby Sumitomo Chemical Co., Ltd.2011D, 50/50% of the weight of the mixed constituent of crystalline polypropylene and an amorphous propylene-butene-1 copolymer (MFR(230 degrees C) =14g /, and ten parts) The Ube Rexene make The film was obtained like the example 1 using same weight (mixture B) 70 % of the weight with CAP355, and (petroleum resin (Yasuhara Chemical chestnut ARON P125) C) 30 % of the weight except having set the (D) component to 0.

[0053]

[A table 1]

	共通				手包装		自動包装					
	透明性 (1)	底 シール性	復元性	張り	仕上がり	ストレッチ性 (1)	イシダ Zero one		テラオカ AW3600			
							カット搬送	仕上がり	カット搬送	ストレッチ性 (2)	仕上がり	透明性 (2)
実施例 1	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
実施例 2	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
実施例 3	◎	○	○	○	◎	◎	◎	◎	◎	○	○	○
実施例 4	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
比較例 1	▲	○	▲	○	○	○	○	○	○	○	○	▲
比較例 2	▲	○	▲	○	○	○	○	○	○	○	○	▲
比較例 3	▲	○	×	○	○	○	◎	○	◎	▲	▲	▲

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